PROBLEMS AND SOLUTIONS.

EDITED BY B. F. FINKEL AND R. P. BAKER.

PROBLEMS FOR SOLUTION.

ALGEBRA.

When this issue was made up, no solution had been received for number 428.

430. Proposed by H. C. FEEMSTER, York College, Nebraska.

Solve the equations

$$\sum_{i=1}^{n} x_i - x_n = k + \frac{n^2 - 3n + 2}{2} d, \tag{1}$$

$$\sum_{i=1}^{n} x_i - x_{n-1} = k + \frac{n^2 - 3n + 4}{2} d, \tag{2}$$

$$\sum_{i=1}^{n} x_i - x_{n-2} = k + \frac{n^2 - 3n + 6}{2} d, \tag{3}$$

$$\cdots \quad \vdots$$

$$\sum_{i=1}^{n} x_i - x_1 = k + \frac{n^2 - n}{2} d. \tag{n}$$

431. Proposed by ELMER SCHUYLER, Brooklyn, N. Y.

Form a magic square of 9 cells such that (the integers being all different) the products of the integers in the rows, columns, and diagonals shall be the same and the smallest product possible.

432. Proposed by C. N. SCHMALL, New York City.

There are n straight lines in a plane, no two of which are parallel, and no three of which are concurrent. Their points of intersection being joined, show that the number of new lines drawn is $\frac{1}{8}n(n-1)(n-2)(n-3)$.

GEOMETRY.

When this issue was made up, no solution had been received for number 459.

460. Proposed by J. W. CLAWSON, Ursinus College, Pa.

ABC is a triangle, O and I the centers of the circum- and in-circles respectively, and I', I'', I''' the centers of the three escribed circles. If AO, BO, CO meet the circumcircle in P, P', P'' respectively, and PR, $P'R'$, $P''R''$ are drawn parallel respectively to AI, BI, CI to meet BC, CA, AB respectively in R, R', R'', prove that: (1) PR, $P'R'$, $P''R''$ are concurrent, say at J. (2) $JO = OI$. (3) JI', JI'', JI''' are perpendicular respectively to BC, CA, AB. (4) AR, BR', CR'' are concurrent.

461. Proposed by CLIFFORD N. MILLS, Brookings, South Dakota.

Prove by means of *any* inscribed triangle the following trigonometrical relations: $\sin 2\beta = 2 \sin\beta \cos\beta$. $\cos 2\beta = \cos^2\beta - \sin^2\beta$. $\sin 3\beta = 3 \sin\beta - 4 \sin^3\beta$. $\cos 3\beta = 4 \cos^3\beta - 3 \cos\beta$.

462. Proposed by DANIEL KRETH, Wellman, Iowa.

A conical glass, the diameter of the base of which is 5 inches and altitude 6 inches, is one-fifth full of water. If a sphere 4 inches in diameter is dropped into it, how much of the vertical axis of the glass is immersed?

463. Proposed by NATHAN ALTSHILLER, University of Washington, Seattle.

Through a given point, to draw a line that cuts off on the sides of a given angle two segments the sum of which has a given value.